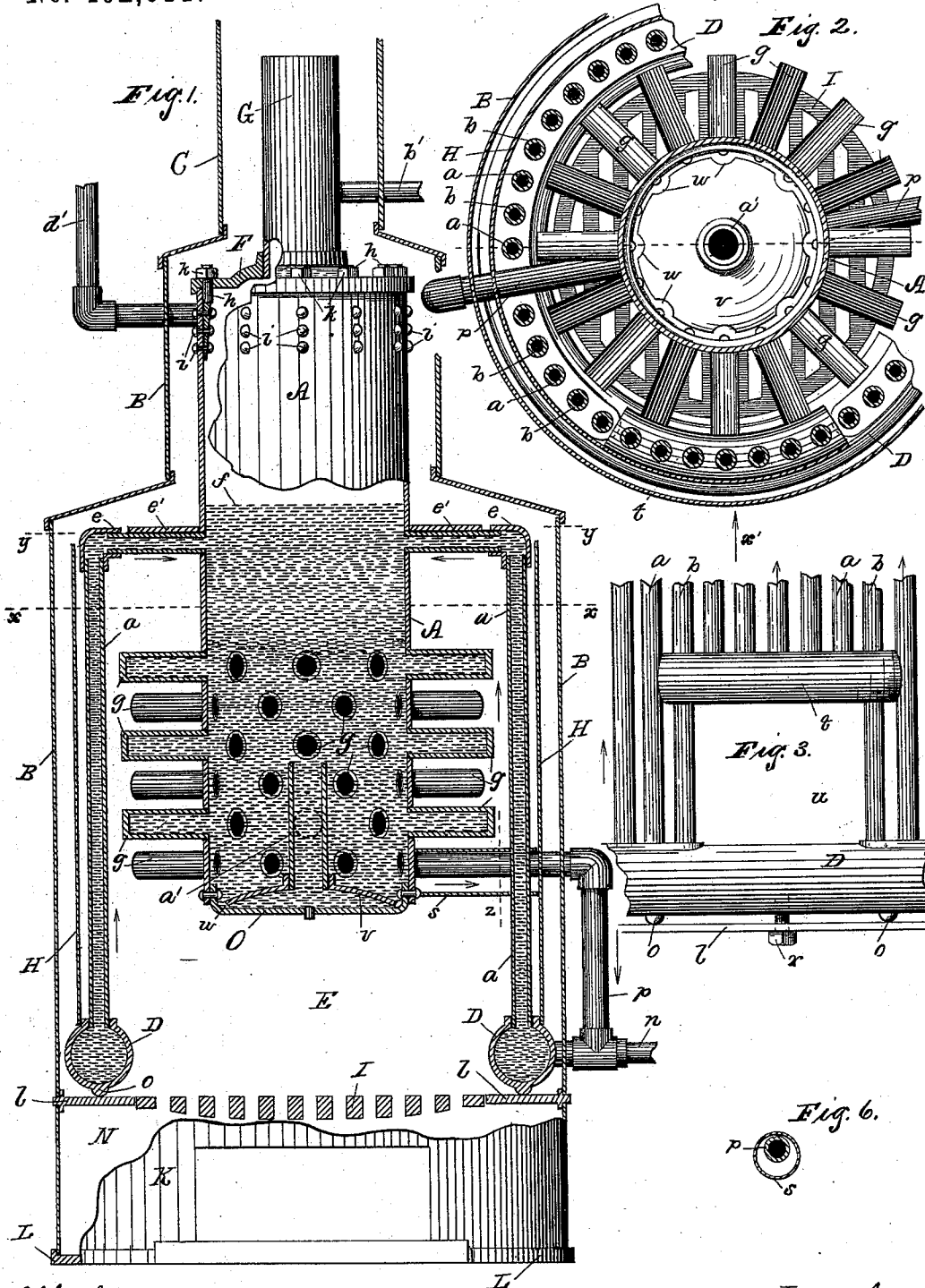


M. E. OTIS.
STEAM BOILER.

No. 402,611.

Patented May 7, 1889.



Attest:
M. L. D. & D. Mott.
F. A. Watson.

Inventor
Marvin E. Otis.
By E. B. Whitmore, Atty.

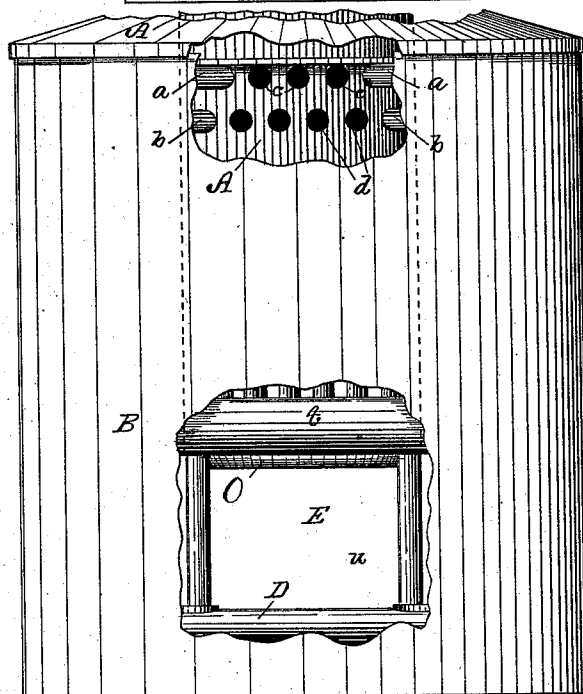
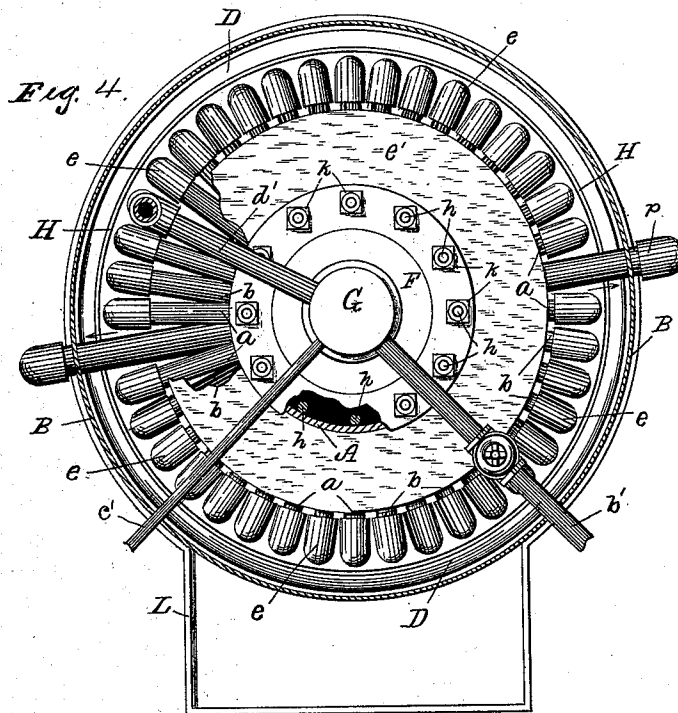
(No Model.)

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UNITED STATES PATENT OFFICE.

MARVIN E. OTIS, OF ROCHESTER, NEW YORK.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 402,611, dated May 7, 1889.

Application filed January 24, 1889. Serial No. 297,390. (No model.)

To all whom it may concern:

Be it known that I, MARVIN E. OTIS, of Rochester, in the county of Monroe and State of New York, have invented a new and useful Improvement in Steam-Boilers, which improvement is fully set forth in the following specification and shown in the accompanying drawings.

The object of my invention is to produce an improved rapid steam-generator, designed more particularly for small engines, for purposes of heating, &c., the same being herein-after fully described, and more particularly pointed out in the claims.

Steam boilers or generators in some respects similar to the one here shown have been made; but they have been attended with certain defects which I have aimed to overcome in this invention. A relatively large water capacity with large heating-surface and a free and rapid circulation for the water are some of the essential features of my invention.

Referring to the drawings, Figure 1 is a central longitudinal section of my improved steam-generator; Fig. 2, a horizontal section taken on the dotted line $x x$ in Fig. 1, parts being broken away; Fig. 3, a front elevation of some of the parts seen as indicated by arrow x' in Fig. 2; Fig. 4, a view of the parts similar to that shown in Fig. 2, the outer jacket being sectioned on the line $y y$ in Fig. 1, parts being broken away; Fig. 5, a front elevation of parts of the device, parts of the jacket being broken away to uncover parts within; and Fig. 6, a transverse section of one of the return-pipes with its jacket, taken on the dotted line z in Fig. 1.

Referring to the parts shown in the drawings, A is the body or main part of a steam boiler or generator inclosed within a suitable outer jacket or covering, B, the latter terminating in a smoke-pipe, C.

D is a water-ring on a level with the furnace E, from which ring pipes $a b$ extend vertically to a distance and then turn horizontally and radially inward to connect with the main part or body A, as shown. The tubes a are all of a length and longer than the alternate tubes b , which are also of uniform length, so that the inwardly-turned ends of these two series of tubes are caused to meet

the body A in two horizontal rows of holes, $c d$, one above the other, as clearly shown in Fig. 5. These tubes $a b$ are of uniform diameter, and the horizontal part of each is joined to the vertical part by a right-angled elbow, e . The vertical parts of all the tubes $a b$ are equally distant from the axis of the body A, and, taken together, form a cylindrical figure rising from the middle of the upper surface of the water-ring D.

The body A is extended downward to the furnace E, so as to afford an ample water-space, the water-line being at f , a short distance above the upper ends of the tubes a . I prefer to provide the body with alternate radial or "porcupine" tubes g below the horizontal parts of the tubes b , as shown in Figs. 1 and 2, this feature by itself, however, not claimed to be new. The outer ends of these radial tubes are closed and reach out nearly to the colonnade of tubes $a b$. All of the tubes thus far mentioned, together with the water-ring, being below the water-line, are constantly filled with water. The head F of the body A is held to the latter by means of threaded bolts h , secured to the shell of the body by rivets i , screw-nuts k being supplied to the bolts above the head. A steam-drum, G, extends upward from the center of the head F.

H is an inner cylindrical jacket, it being just outside of the tubes $a b$. The ring D and the outer jacket, B, rest upon a horizontal supporting-plate, l , annular in form, this plate supporting the superstructure of the device. This plate in turn rests upon a stiff band, K, which is held by a base or bottom plate, L. Within the band K is the ash-pit N.

A grate, I, of any suitable form, is placed at the bottom of the furnace and over the ash-pit. $p p$ are a pair of circulating or return pipes for the water, joining the ring D with the lower portion of the body A on opposite sides of the latter. These, together with the tubes $a b$, joining the ring with a different part of the body A—that is to say, at points just beneath the water-line—admit of a rapid and free circulation between the water in the ring and in the body A. One or both of these return-pipes are provided with blow-off pipes n , and each is provided with a protecting-jacket, s , to modify the action of the heat upon them, so that the flow of water will be downward

through said pipes and upward through the tubes *a b*, as indicated.

The ring *D* is formed with feet or projections *o*, that rest upon the plate *l*, and clamping-screws or simple fasteners *r* serve to bind the tube and plate together. These projections *o* serve to raise the ring above the plate and the upper surface of the grate, so that it may form in part the outer wall of the furnace, which admits of the water contained therein being rapidly acted upon by the heat from the burning fuel.

At the door of the furnace the tubes *a b* connect with a short horizontal pipe, *t*, leaving an opening, *u*, beneath it.

Within the body *A*, at the bottom, I provide a device for agitating the sediment for the purpose of preventing an incrustation upon the head *O*. This device consists of an arched plate, *v*, Figs. 1 and 2, resting upon the head *O*, having peripheral notches *w*, through which the water may flow downward beneath the plate. At the center the plate is provided with a tube, *a'*, extending upward within the body of the boiler, to cause an upward flow of the heated water beneath the plate. This constant flow of water through the notches *w* and upward through the tube acts as an agitator for the mud and prevents it becoming fixed to the head.

Pipes *b'*, *c'*, and *d'* are provided, leading to the engine, the steam-gage, and the whistle or other part, the latter pipe extending either from the body *A*, as shown in Fig. 1, or from the steam-drum *G*, as shown in Fig. 4.

I provide an annular plate, *e'*, surrounding the body *A* and resting upon the upper parts of the tubes *a*. This plate serves to deflect the ascending heat-currents outward against the upper parts of the tubes *a b*, the currents

passing upward through the annular space between the periphery of the plate *e'* and the upper edge of the inner jacket, *H*. The water, being divided into small bodies in the various tubes *g* and *a b*, is rapidly attacked by the furnace heat and quickly converted into steam.

What I claim as my invention is—

1. In a steam-boiler, in combination with the main body, a hollow ring below the body, a series of tubes joining the ring and body, said tubes being equidistant from the body, the latter being extended below the upper ends of said tubes and having its convex surface provided with radial horizontal tubes closed at their outer ends, and circulating or return pipes outside of said series of tubes joining the ring and body, substantially as shown and described.

2. In combination with the body of a steam-boiler, a hollow ring below the body, a series of tubes, *a b*, extended upward from the ring and joined to the body, the latter being extended downward below the upper ends of said tubes, circulating-pipes *p*, joining said rings and body, and protectors for said pipes, substantially as described.

3. In a steam-boiler, in combination with a central body, a hollow ring below the body, a series of tubes joining the ring and body, an inner cylindrical deflecting-jacket, *H*, surrounding said tubes, an annular deflecting-plate above said tubes, and an outer jacket, *B*, said deflecting-jacket and plate forming an annular space between their adjacent edges, substantially as shown.

MARVIN E. OTIS.

Witnesses:

E. B. WHITMORE,
M. L. McDERMOTT.